



K22U 1302

Reg. No. : .....

Name : .....

**II Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/  
Improvement) Examination, April 2022  
(2019 Admission Onwards)  
CORE COURSE IN PHYSICS  
2B02PHY : Mathematical Physics and Error Analysis**

Time : 3 Hours

Max. Marks : 40

**PART – A**

Short answer questions. Answer **all** questions. **Each** question carries **1** mark.

1. What do you mean by the scalar product of two vectors ? Give two of its properties.
2. Give the geometrical interpretation of the gradient of a scalar quantity.
3. Give an expression for an infinitesimal displacement in cylindrical co-ordinates.
4. What do you mean by mathematical modeling ?
5. When will you say that a first order ordinary differential equation is linear ?
6. What do you mean by a random error ? (6×1=6)

**PART – B**

Short essay questions. Answer **any 6** questions. **Each** question carries **2** marks.

7. Find the gradient of the function  $r = \sqrt{x^2 + y^2 + z^2}$ .
8. Explain what is meant by line and surface integrals.
9. What are irrotational fields ? Discuss their features.
10. Write down expressions for gradient and divergence in cylindrical co-ordinates.
11. Explain what is meant by first order, second order and third order ordinary differential equations. Give an example for each.
12. Solve the ordinary differential equation  $y' + 2\sin 2\pi x = 0$  by integration.
13. Find a general solution to  $4y'' - 25y = 0$ .
14. Explain what do you mean by parallax. (6×2=12)

P.T.O.



## PART – C

Problems. Answer **any 4** questions. **Each** question carries **3** marks.

15. Show that the divergence of the curl of a vector is always zero.
16. Obtain the Laplacian of the functions
  - i)  $T = \sin x \sin y \sin z$  and
  - ii)  $T = e^{-5x} \sin 4y \cos 3z$ .
17. Using the expression for an infinitesimal volume element in spherical polar co-ordinates, obtain the volume of a sphere.
18. Find the general solution of the differential equation  $y' - y = 5.2$ .
19. Find the curve through the origin in the  $xy$ -plane which satisfies  $y'' = 2y'$  and whose tangent at the origin has slope 1.
20. The Length of an object is measured 5 times and the values are obtained as 22.8 cm, 23.1 cm, 22.7 cm, 22.6 cm and 23.0 cm. Determine the mean and standard deviation of the data. **(4×3=12)**

## PART – D

Long essay questions. Answer **any 2** questions. **Each** question carries **5** marks.

21. Explain the divergence of a vector function and give its geometrical interpretation. Discuss Gauss's theorem and illustrate it geometrically.
  22. Using a suitable figure, illustrate spherical polar co-ordinate system. Write down the relations connecting the variables in spherical polar and Cartesian co-ordinate systems. Express the differential displacement vector, differential area vector and differential volume element in spherical polar co-ordinate system.
  23. Explain the geometrical meaning of a first order ordinary differential equation. Discuss the Euler's method of solving ordinary differential equations numerically.
  24. Discuss the rules for propagation of errors. Also explain the general formula for error propagation. **(2×5=10)**
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